NATO Science for Peace and Security Series B: Physics and Biophysics 2008, pages 193-238

Anisotropic exchange in spin chains

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Abstract

Quasi-one-dimensional (1D) spin systems are highly unconventional materials, which exhibit a wide variety of phenomena, including spin-Peierls transition and charge ordering. In this paper, we show that electron spin resonance (ESR) is a very powerful tool to study spin relaxation mechanisms in these systems. We review the microscopic theory of superexchange and include a discussion of some recent experimental and theoretical developments concerning ESR in 1D solids. Furthermore, we evaluate the anisotropy and the temperature dependence of the ESR linewidth in three 1D systems (LiCuVO4, CuGeO3, α'-NaV2O5). Thus, we can determine the type and the magnitude of the anisotropic exchange interactions between spins and investigate the effects of fluctuations of charge and lattice degrees of freedom in the vicinity of phase transitions in these systems.

http://dx.doi.org/10.1007/978-1-4020-8512-3-14